

App. No. 10/848,742
Office Action Dated April 14, 2005
Amd. Dated July 14, 2005

REMARKS

Reconsideration is respectfully requested in view of the above amendments and following remarks. Claims 5, 65 and 66 have been amended editorially. The revision of claim 5 is supported, for instance, at page 16, lines 35-37 and page 17, lines 1-5. The revision of claim 65 is supported, for instance at page 28, lines 7-13. The revision of claim 66 is supported, for instance at page 28, lines 32-33. Applicants respectfully submit that no new matter is added by the proposed revisions. Claims 1-3, 5, 12-17, 39, 41, 42, 45, 47, 48, 51, 61-63, 65, 66, 69, 71 and 72 are pending.

Double Patenting

Claims 1-3, 5, 12-17, 39, 41, 42, 45, 47, 48, 51, 61-63, 65, 66, 69, 71 and 72 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-34, 57 and 58 of U.S. Patent No. 6,767,655 B2.

Applicants wish to overcome the instant rejection by submitting a terminal disclaimer. Applicants do not concede the correctness of the rejection.

Favorable reconsideration and withdrawal of the rejection are respectfully requested.

Claim Rejections - 35 U.S.C. § 112

Claims 65 and 66 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite.

An editorial clarification has been made in claim 65. Claim 65 now recites a buffer layer "made of a composition including a non-magnetic element, in which 10wt% to 50wt% of a non-magnetic element is also present in a magnetic layer in contact with the buffer layer." The claim recites a saturation magnetization for the composition for the buffer layer. This feature is discussed, for example, at page 28, lines 7-13. Thus, Applicants respectfully assert that this feature is supported and definite.

Claim 66 has been editorially amended to be in accordance with the revisions of claim 65. Therefore, this claim is definite for at least the same reasons with respect to claim 65.

App. No. 10/848,742
Office Action Dated April 14, 2005
Amd. Dated July 14, 2005

For at least the foregoing reasons, Applicants respectfully submit that the features of the claims are supported and definite.

Favorable reconsideration and withdrawal of the rejection are respectfully requested.

Claim Objection

Claim 5 is objected as being informal. An editorial correction has accordingly been made in claim 5. Applicants respectfully submit that claim 5 is formal. Withdrawal of the objection is respectfully requested.

Claim Rejections - 35 U.S.C. § 102

Claims 1-3, 5, 12-14, 17, 39, 45, 51, 65, 66 and 69 are rejected under 35 U.S.C. 102(e) as being anticipated by Fukuzawa et al. (U.S. Patent App. No. 2005/0030676 A1). Applicants respectfully traverse this rejection.

Claim 1 is directed to an MR element that comprises a free layer and a pinned magnetic layer sandwiching a non-magnetic layer, wherein the free layer or the pinned layer comprises a pair of magnetic layers sandwiching a non-magnetic layer. Claim 1 recites the non-magnetic layer having a thickness d in the range of $2.6 \text{ nm} \leq d < 10 \text{ nm}$ (herein after described as 2.6 to 10 nm).

Although Fukuzawa et al. describes a case of the MR-improving layer (which the rejection considers analogous to the claimed "non-magnetic layer") with a thickness of 2 to 5 nm in paragraph 0515, the MR-improving layer is disposed under the free layer in a structure of an MR element having the free layer and the pinned layer sandwiching the non-magnetic layer. Therefore, this case is different from the case in which the free layer itself includes the pair of magnetic layers sandwiching the MR-improving layer as required by claim 1.

Fukuzawa et al. also describes a case of the MR-improving layer with a thickness of 0.5 to 2 nm in paragraph 0558. The thickness in this range corresponds to Sample 3 (0.7 nm thick) in Fig. 6 of the present application. Sample 3 represents a comparison example in which a free layer on a Al_2O_3 layer is composed of NiFe(5 nm thick)/Ru(0.7 nm thick)/NiFe(3 nm thick). In this case, as shown in Fig. 6, when the element width is 5

App. No. 10/848,742
Office Action Dated April 14, 2005
Amd. Dated July 14, 2005

nm or more, the coercivity (H_c) is similar to Sample 2 (3 nm thick). However, when the element width is below 5 nm, coercivity is increased abruptly, unlike Sample 2.

Sample 2 represents the Applicants' invention, in which a free layer on a Al_2O_3 layer is composed of NiFe(5 nm thick)/Ta(3 nm thick)/NiFe(3 nm thick). In this case, as shown in Fig. 6, even when the element width is below 5 nm the coercivity is maintained within a low range.

The difference between Sample 2 and 3 is explained with reference to Fig. 5. In Sample 3, the exchange coupling is dominant because the NiFe layers are close to each other, while in Sample 2 the magnetostatic coupling is dominant without the exchange coupling. Fukuzawa et al. discloses only the case corresponding to Sample 3 shown in the Applicants' application, which as discussed above represents a different mode of operation from the presently claimed invention. Further, Fukuzawa et al. does not teach or suggest that a thickness of the MR-improving layer is set to be in the range of 2.6 to 10 nm so as to utilize the magnetostatic coupling without utilizing the exchange coupling, whereby the coercivity is maintained within a low range, even when the element area is not larger than $1000 \mu m^2$.

For at least the foregoing reasons, Applicants respectfully submit that claim 1 is patentable over Fukuzawa et al.

Claims 2, 3, 5, 12-14, 17, 39, 45, 51, 65, 66 and 69 are patentable over Fukuzawa et al. for at least the same reasons as claim 1.

Favorable reconsideration and withdrawal of the rejection are respectfully requested.

Claim Rejections - 35 U.S.C. § 103

Claim 71 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuzawa et al. as applied above, and further in view of Sakakima et al. (J. Mag. Mag. Mat., 210, 2000, L20-L24). Applicants respectfully traverse this rejection.

Fukuzawa et al. has been distinguished above. Claim 71 depends upon and further limits claim 1 discussed above as patentable. Claim 71 is patentable over Fukuzawa et al. and Sakakima et al. for at least the same reasons as claim 1.

Furthermore, it would not be obvious that the cited references could reasonably be

App. No. 10/848,742
Office Action Dated April 14, 2005
Amd. Dated July 14, 2005

combined to arrive at the features of the present invention or any advantages enjoyed by the present invention.

Favorable reconsideration and withdrawal of the rejection are respectfully requested.

Claims 47 and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuzawa et al. as applied above, and further in view of Redon et al. (U.S. Patent No. 6,381,107 B1). Applicants respectfully traverse this rejection.

Fukuzawa et al. has been distinguished above. Claim 48 depends upon and further limits claim 47. Claim 47 depends upon and further limits claim 1 discussed above as patentable. Claim 47 and 48 are patentable over Fukuzawa et al. and Redon et al. for at least the same reasons as claim 1. Furthermore, it would not be obvious that the cited references could reasonably be combined to arrive at the features of the present invention or any advantages enjoyed by the present invention.

Favorable reconsideration and withdrawal of the rejection are respectfully requested.

Claims 1, 5, 12, 13, 15, 17, 39, 45 and 71 are rejected under 35 U.S.C. 103(a) as being unpatentable over Odagawa et al. (U.S. Patent App. No. 2002/0058158 A1) in view of Parkin (U.S. Patent No. 5,585,986). Applicants respectfully traverse this rejection.

Odagawa et al. is directed to an MR element comprising a free layer (Fig. 8C, element 130) and a pinned magnetic layer (element 110) sandwiching a non-magnetic layer (element 120), wherein the free layer or the pinned layer is composed of a pair of magnetic layers (element 230/260 and 250/280) sandwiching an MR-improving layer (element 240/270). However, Odagawa et al. discloses that the thickness of the MR-improving layer falls between 0.4 and 1 nm (Paragraph 229). The structure is intended to utilize the exchange coupling, and therefore fails to teach the features of claim 1 for the reasons discussed above.

Parkin teaches that a thickness of a non-magnetic spacer layer can be selected in order to produce a laminated structure wherein the magnetic layers are separated by the non-magnetic spacer layer (Fig. 5 and col. 6, lines 35-52). Particularly, depending on the choice of material, Parkin teaches that antiferromagnetic coupling can be achieved by

App. No. 10/848,742
Office Action Dated April 14, 2005
Amd. Dated July 14, 2005

utilizing thickness values meeting Applicants' claimed limitation. The Examiner discusses that what is taught by Parkin can be applied to what is taught by Odagawa et al.

However, neither Parkin nor Odagawa et al. teach or suggest the features of claim 1. Particularly, neither Parkin nor Odagawa et al. disclose a thickness of the non-magnetic layer set in the range of 2.6 to 10 nm so as to utilize magnetostatic coupling without using the exchange coupling, whereby the coercivity is maintained within a low range, even in a case of a small width or a small element area that is not larger than 1000 μm^2 . Further, the difference in the thickness of the non-magnetic layer is technically distinctive from the viewpoint of whether coercivity is caused abruptly, as in exchange coupling, or not caused abruptly, as in magnetostatic coupling, when the element area is not larger than 1000 μm^2 (Fig. 6 and page 33, lines 3-16). Accordingly, neither Parkin nor Odagawa et al. disclose the features of claim 1. Furthermore, it would not be obvious that the cited references could reasonably be combined to arrive at the features of the present invention or any advantages enjoyed by the present invention. Therefore, it is respectfully submitted that claim 1 is patentable over Parkin and Odagawa et al.

Claims 5, 12, 13, 15, 17, 39, 45 and 71 are patentable for at least the same reasons as claim 1.

Favorable reconsideration and withdrawal of the rejection are respectfully requested.

Claims 2, 14, 16, 51 and 61-63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Odagawa et al. as applied above, and further in view of Fukuzawa et al. ('676 A1). Applicants respectfully traverse this rejection.

Fukuzawa et al. and Odagawa et al. have been distinguished above. Claims 2, 14, 16, 51 and 61-63 depend upon and further limits claim 1 discussed above as patentable. Claims 2, 14, 16, 51 and 61-63 are patentable over Fukuzawa et al. and Odagawa et al. for at least the same reasons as claim 1. Furthermore, it would not be obvious that the

cited references could reasonably be combined to arrive at the features of the present invention or any advantages enjoyed by the present invention.

App. No. 10/848,742
Office Action Dated April 14, 2005
Amd. Dated July 14, 2005

Favorable reconsideration and withdrawal of the rejection are respectfully requested.

Claims 47 and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Odagawa et al. as applied above, and further in view of Redon et al. ('107 B1). Applicants respectfully traverse this rejection.

Odagawa et al. has been distinguished above. Claim 48 depends upon and further limits claim 47. Claim 47 depends upon and further limits claim 1 discussed above as patentable. Claim 47 and 48 are patentable over Odagawa et al. and Redon et al. for at least the same reasons as claim 1. Furthermore, it would not be obvious that the cited references could reasonably be combined to arrive at the features of the present invention or any advantages enjoyed by the present invention.

Favorable reconsideration and withdrawal of the rejection are respectfully requested.

With the above amendments and remarks, Applicants believe that the pending claims are in a condition for allowance. Applicants respectfully request favorable reconsideration by the Examiner in the form of a Notice of Allowance. If any questions arise, the Examiner is invited to contact Applicants' representative at the number listed below.

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Respectfully Submitted,



Douglas P. Mueller

Reg. No.: 30,300

Hamre, Schumann, Mueller & Larson, P.C.

225 South Sixth Street

Suite 2650

Minneapolis, MN 55402

612.455.3800

DPM/ym